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Final report on DURIP Grant

Antenna-Coupled Uncooled Infrared Focal Plane Arrays: In-house Fabrication

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*Abstract:*

Under the support of the subject DURIP grant, University of Central Florida CREOL has developed an in-house capability for direct-write electron-beam fabrication of the microantenna coupled infrared sensors being investigated for contract to BMDO. The facility developed has resulted in shorter turn-around times for exploration of new device designs while giving a greater degree of process control. Establishment of this facility at CREOL has provided a cost-effective means for prototype device development for infrared focal-plane array applications.

The main goal of the DURIP program “Antenna-Coupled Uncooled Infrared Focal Plane Arrays: In-house Fabrication” was to develop a fabrication facility for direct-write electron-beam lithography. The objectives of the lithographic fabrication are antenna-coupled IR sensors of the type shown in Fig. 1, for which the required on-chip resolution is around 0.1  $\mu\text{m}$ .

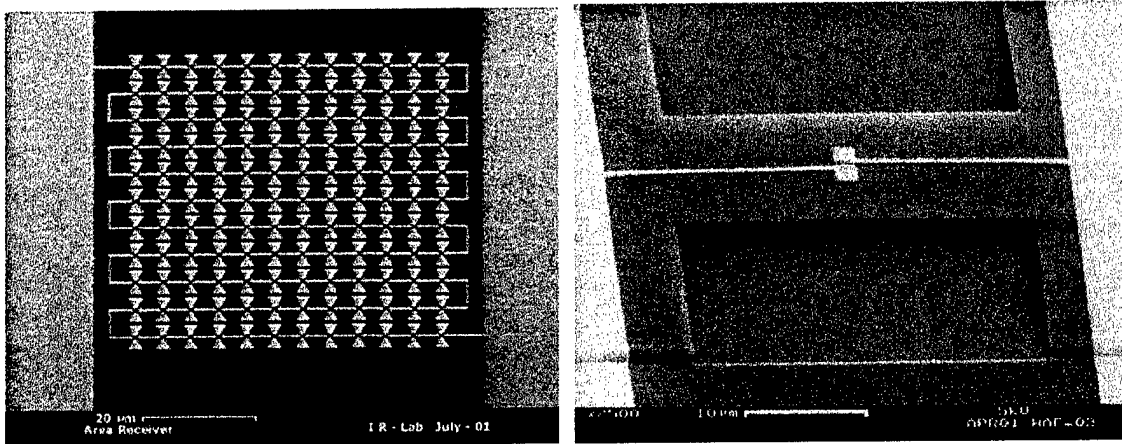


Figure 1. Antenna-coupled IR sensor array; antenna-coupled IR sensor on air bridge.

To this end, we purchased and installed the following major equipment in a purpose-built 400-square-foot class-10,000 cleanroom located in the PI's laboratory (Infrared Systems Laboratory) at CREOL.

- JEOL JSM-5900 Scanning Electron Microscope
- Raith ELPHY beam-control system for direct-write lithography
- Materials Research Corp. MRC8667 Sputter Deposition System
  - Includes both DC/RF sputtering tools
  - Current material capabilities include Au, Al, Ni, NiO, VO<sub>x</sub>, Ti, Si, SiO<sub>2</sub>
- Pure Aire Laminar Flow System
- Headway Research Corp. Resist Spinner

Through other funding sources, including University Matching Grants and externally funded contracts, we were able to complement the above items with other fabrication tools and equipment. Figure 2 shows photos of the completed facility with all equipment installed.

- Branson P2000 plasma etching system
- Structure Probe critical point dryer
- Wafer probe station
- HP 4145 semiconductor parameter analyzer
- Karl Suss wafer scribe
- West Bond wire bonding station
- Olympus inspection microscope

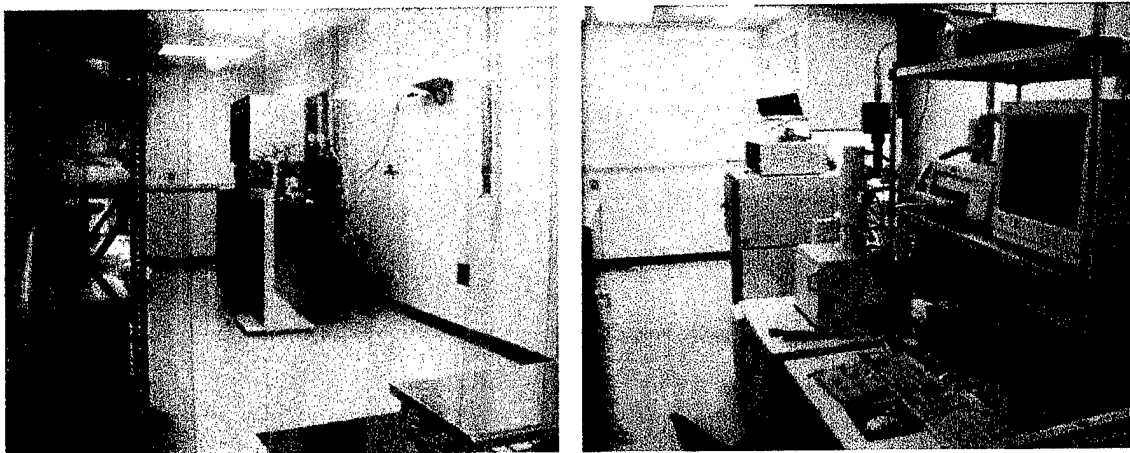


Figure 2. Anteroom with gowning area and sputtering system; inner chamber with e-beam lithography system, resist processing station, and plasma etching system.

UCF/CREOL graduate students who presently use this facility for their thesis research:

- Michael Gritz, PhD Student in EE  
E-beam fab, specialized etch chemistry, antenna design.
- Javier Gonzalez, PhD Student in EE  
E-beam fab, low-noise electronics, antenna design.
- Mo Rahman, PhD Student in EE  
Low-noise electronics, RF techniques.
- Brian Monacelli, PhD Student in Optics  
Optical testing and sensor evaluation.